THE TWENTIETH CENTURY HAT FACTORY

OF

THE LEE-McLACHLAN COMPANY

By

DAVID C. MILLS

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DAVID C. MILLS

ILLUSTRATED

THE LEE-McLACHLAN COMPANY
DANBURY, CONNECTICUT
1910-1911

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THE TWENTIETH CENTURY HAT FACTORY

SINCE the publication of this book in 1911, the name of the corporation has been changed to THE FRANK H. LEE CO., and the "TWENTIETH CENTURY HAT FACTORY" is now devoted exclusively to the business of the Lee interests. It is presented to the trade with our compliments and we hope that it will be of interest to you.

Sincerely yours,

THE FRANK H. LEE CO.

I

INTRODUCTION

The Lee-McLachlan Factory

WE may say, without exaggeration, that no hat factory constructed in recent years has been the cause of so much discussion, so much criticism, favorable or otherwise, as the one recently erected and now in operation in the City of Danbury, known as the Lee-McLachlan factory. It is natural that there should be much discussion regarding this plant. It is the most ambitious undertaking of the kind that has ever been attempted in Connecticut (although there are several larger factories in Massachusetts, New York and Pennsylvania), and it is the most modern factory making both soft and stiff hats in the United States. It is unfortunately true that practically all of the discussion regarding this enterprise has been lacking in a proper basis of knowledge of what the factory really is and what are the aims or purposes of its owners. It is to fill this want that this book is written.

This factory was built to accommodate the normal amount of production of the four factories heretofore operated separately by Mr. Lee and Mr. McLachlan; that is to say, two rough shops, one soft shop and one stiff shop. The Lee-McLachlan Company is not, in reality, a manufacturing concern in the usual sense. It is a company formed for the purpose of providing a common plant, common power, common operating staff and common facilities for the manufacture of

hats according to the individual requirements and necessities of two manufacturers. The Lee-McLachlan Company will make hats of the Lee kind, and also of the McLachlan kind. While this may appear to be a matter capable of endless confusion, it will not prove to be so in fact, for the whole difference will be provided for in the tickets made out in the office and accompanying each group of hats in its passage through the factory.

It is, therefore, apparent that the aim of this company is first to reduce the overhead expenses of the two concerns by furnishing one plant, then to reduce the direct costs on all goods by furnishing a thoroughly practical modern plant. These two functions are distinct, and this fact should be borne in mind now and in the future, for it is an innovation involving a degree of co-operation hitherto untried. Of course, the two groups of factories involved were not competitors, and it is impossible that such an arrangement could be worked satisfactorily by competing firms; but if it works smoothly in this case it will, in all probability, be followed by other groups of non-competing factories.

In building the factory it was planned to provide a capacity equivalent to that of the combined four factories it supersedes, but it was also planned to provide for any necessary expansion of capacity the future might make necessary, although this was a secondary consideration. The arrangement, or layout, of buildings and machinery is designed to permit of almost unlimited capacity expansion without

The Four Old Factories

S. A. G. HAT CO.

THE LEE SOFT HAT FACTORY

THE LEE STIFF HAT FACTORY

H. McLACHLAN & CO.

disturbance to the continuity of processes. The long, narrow wings placed at right angles are peculiarly adaptable to such expansion.

The four factories formerly operated by the two firms consisted of relatively small main buildings, with innumerable additions built on from time to time, for which the original plan of the main building did not provide and which added confusion to chaos, which, it may be said, is the general rule in hat factories.

It is a difficult thing to arrange a plant, so that the hat will go from one process to another without retracing its course at any point. It is further complicated by the necessity of segregating the black from the colored stock during several processes. To this is added the further complication of the necessity of working soft and stiff hats in separate departments throughout a part of their courses. To add floor space without disturbing the balance of all the departments is something that requires great foresight and knowledge of mill construction.

The factory consists primarily of one narrow L-shaped building, composed of two wings. All the actual manufacturing processes, from the blowing of the fur to the packing of the hats, are conducted in this building. The offices, fur and shellac storehouse and power plant are in three separate buildings, placed within the angle formed by the wings of the main building. Three switches, one owned by the railroad, the others by the company, provide facilities for receiving or shipping coal, materials and hats.

POWER HOUSE EQUIPMENT

The power house is a brick structure absolutely fireproof, with concrete foundations, 93 feet x 64 feet. The power is furnished by three boilers of a total of 1,000 horsepower. Two boilers are sufficient to furnish all heat and power under ordinary conditions, while the third is used as an auxiliary. There is ample room for the installation of a fourth boiler, which would permit of the development of sufficient power to run the factory at double its present normal capacity.

The power throughout the entire shop is generated by two Corliss engines of the latest type, direct connected to two generators having a combined capacity of 700 kilowatts. It is only necessary to make use of one unit under ordinary conditions, the other being held in reserve for emergency or any unusual load.

The water for the kettles is first heated by the exhaust from the engines in coils in the basement of the power house, after which it is pumped to the kettles and kept at the right temperature by the injection of exhaust steam.

The use of exhaust steam, that usually is neither more nor less than waste power, and consequently waste dollars, is carried out to the very last point of efficiency in this plant. Not only is it used in heating the kettles, but also in the ventilating process, to be described later, and in the drying rooms as well as for heating the buildings in winter and preserving the requisite degree of humidity in certain departments at all times. Of course, its use for these purposes in-

volves the cost represented by a back-pressure of about six pounds, which slightly affects the engine efficiency, but this cost is infinitesimal in comparison with the usual waste when using live steam. A back-pressure valve is provided to admit live steam from the boilers, to help out the exhaust under unusual conditions, but, as a rule, the exhaust is sufficient for all ordinary purposes. The result is economy, the paring down of coal bills to the last degree, the reduction of one of the most important overhead costs of manufacture.

POWER TRANSMISSION

The direct-connected motor is everywhere in the new factory, and belts and shafting practically nowhere. This is carried out in every department to the great benefit of the operatives and to the equally great benefit of the owners. With all kinds of employers' liability legislation "in the air," it behooves the manufacturer to safeguard the employees from unnecessary risk, as well from a strictly practical standpoint as from that of the humanitarian. But aside from any danger of loss through damages in case of accident there is a direct loss not easily measured when a man is injured in the shop, a loss due to the demoralization of the whole force. Manufacturers are coming into a greater appreciation of this risk, and in consequence belts, shafts, and all the innumerable dangers of the old-fashioned factory are disappearing.

There is claimed for the "individual motor-driven system" that it is more economical in point of actual cost than shaft-driven machin-

ery, but that is a matter of question still open for debate. The fact remains, however, that it is the safest, the cleanest, and generally the most satisfactory method.

Ventilation, Humidity, Temperature and the Control of Excess Steam in the Sizing Room

The "Sturtevant System" is installed for the purpose of ventilation and for the elimination of steam in the plank shop. This consists of a motor-driven fan that draws air from the open through a radiator, which is heated by the exhaust from the engine, driving it thence through conduits to various points in the plank shop, where it is let into the room through easily-regulated orifices near the floor. The heated air keeps the steam in a sufficient state of vaporization to permit of its being pumped out of the room through a return series of conduits.

This system not only removes the steam, which is frequently a source of annoyance in the plank shop, but it also admits of a complete change of air throughout the entire plant in an incredibly short time (about five minutes, if necessity requires), and regulates the temperature of the rooms at the same time.

The matter of humidity in all the processes of hat manufacture is most important. In the blowing room this is always provided for by the injection of steam into the room until the required degree of humidity is obtained. Usually live steam is used, but again in this shop the usage is to employ waste steam, steam that has expended

every available pound of its energy that is capable of being used as motive power, and, in this particular department, the steam used is the exhaust from the plank shop.

THE FACTORY BUILDING

There has been some astonishment that this concern did not follow the precedents established in recent examples of factory construction in the hat trade, and build a concrete and steel structure. It is recognized that the difference in cost, though considerable in a factory of this size, would not be of such importance to deter the men who had the planning of this enterprise in mind. There are considerations favoring the use of concrete that so far outweigh the difference in cost that there must be some good reason for not using it in the present case. The reason is simple enough. One may accept it as rational or otherwise—and it is a matter open for differences of opinion.

Messrs. Lee and McLachlan, after weighing all the advantages and disadvantages of both wood and concrete construction, decided on the former chiefly because of their belief in the superiority of wooden buildings for hat manufacture, regardless of its possible disadvantages in other trades. They hold that humidity and temperature are more readily controlled in the well-built wooden structure than in the brick or concrete building. The construction presents no apparent changes from other recent examples of first-class mill construction, excepting that it is worthy of note that the building is separated into

several comparatively small fire zones by the erection of substantial fire walls with modern firedoors, etc. In consequence of this, their insurance rates are *one-fifteenth* of their rates in the old shops.

The sprinkler system is especially worthy of note on account of its ample capacity. It has not been very many years since sprinklers were first installed, but, as time goes on, there are more and more instances of the failure of sprinkler systems when and where most needed. It is no very intricate task to lay out a system. One merely figures distances, friction, and diameters of pipes, seeing to it that the standpipes and mains are of sufficient capacity to feed all the branches, and that the pressure is sufficient to overcome the loss of head through friction. But in the older systems the loss of head was figured on a basis of the friction on a new pipe and did not provide for additional loss due to incrustations that form within the tubes. It is known now that these incrustations are sufficient, in the course of years, to effect a complete loss of head in so large a tube as a 12-inch water main, so that with high pressure at the headgate the engines have struggled with a vacuum at the other end, a mile or so away. In the necessarily smaller pipes of a factory sprinkler system this question becomes one of prime importance, and it can only be overcome by the use of large pipes with frequent connections with the mains. The sprinkler system in this shop is certainly ample to meet any requirement now and for years hence, and a careful examination of it would, no doubt, lead many a manufacturer to install a new sprinkler system for the sake of safety and reasonable insurance rates.

THE BUILDING

The main building consists of two wings, joined by a brick tower. The southern wing, containing the back shop departments, is of two stories for part of its length (308 feet), rising to three on approaching the angle (a distance of 110 feet). The tower and front shop wing are of four stories throughout, the front shop wing being 280 feet long. The distance from end to end of the factory along the outer wall is 778 feet.

It may be somewhat more interesting to trace the processes from place to place rather than to describe the factory one floor after another.

BLOWING ROOM

The blowing room is on the second floor at the extreme end of the back shop wing. Its equipment is like that in use elsewhere, but there is a difference from ordinary usage in the larger number of sections to each blower. There are 16 sections to each, 208 sections all told. The machines are driven with direct-connected motors. The room itself is 165 feet by 40 feet. As stated previously the humidity is regulated by the injection of waste steam from the plank shop.

FORMING ROOM

The forming room is immediately under the blowing room on the first or ground floor. It is also 165 feet by 40 feet, and contains 15

formers, with a daily capacity of from 50 to 60 dozens each. This, of course, is the measure of the factory's capacity under present conditions. The formers are of an improved design, having self-oiling bearings, and direct-driven side-draft exhaust fan, capable of adjustment according to the weight of the hats. The tubs for the immersion of the newly-formed bodies are sunk in the cement floor, while troughs, sunken in the floor, provide adequate drainage. The exhaust room is a cement chamber beneath the floor of the forming room.

PLANK SHOP

The stiff hat sizing room is on the first floor, but as this process is the first in which there is any radical difference for soft and stiff hats, the soft hat plank shop is placed on the second floor.

The stiff hat blocking, stretching and stiff and soft black dyeing are all done on the first, but all fancy-colored goods are dyed on the second floor. The stiffening room is also on the second, a part of which is also devoted to an alcohol recovery apparatus.

The third floor of the back shop wing is a storage room for hat bodies, and also accommodates a soft hat pouncing department.

Dimensions are of some interest. Taking the back shop wing, floor by floor, we can give the dimensions more readily than otherwise.

The extreme length of the first floor on the outer wall, including the connecting tower, is 458 feet, while its width is 40 feet. The tower is 40 feet by 40 feet. The stiff hat plank shop, including dyeing,

blocking and stretching departments, is 231 feet by 40 feet. A dressing room between the forming and sizing room is 22 feet by 40 feet. The forming room is 165 feet by 40 feet.

On the second floor the blowing room is 165 feet by 40 feet, dressing room, 22 feet by 40 feet; soft hat sizing room, 143 feet by 40 feet; stiffening room, 88 feet by 40 feet.

The third floor storage room for bodies is 110 feet by 40 feet.

DRYING APPARATUS

In hat manufacture as much of the real work is accomplished by wetting and drying the felt as by the "elbow-grease" of the employees. It is a simple matter to wet the bodies, but everlastingly tedious and difficult to dry them properly.

The old way was to place them on racks, in a room surrounded by steam pipes. No attempt was made to draw off the moisture-laden air, and hats dried in from twelve to twenty-four hours. Then fans were installed to pump out the moisture. Later the idea was conceived of raising the hat slowly through a heated chimney-like room. Still later, a drying room was made in which the hats, resting on racks, were subjected to a strong current of heated air, which was immediately pumped from the compartment.

The system in use at the Lee-McLachlan factory combines these last-mentioned systems. The tower at the angle of the two wings is principally devoted to the drying elevator, for so it should properly be called. An endless chain sprocket, traveling over a series of sprocket wheels at the top and near the floor of one side of the room

or shaft, is connected by a number of rods to a similar chain traveling over a corresponding series of sprocket wheels at the other side of the room. The hat racks are hung on hangers, swinging freely upon these rods, each carrying a dozen wet hats. As the sprocket wheels revolve the chain elevator carries its load upward slowly, downward, upward again, and so on.

In the cement floor of the shaft are a number of holes, perhaps a foot in diameter, through which hot air is forced upward into the chamber. This air takes up the moisture, and, under pressure, carries it through outlets in the ceiling to the open air. The air pressure is furnished by a powerful blower adjacent to the drying chamber that forces the air through a tubular heater capable of being raised to any desired temperature by the injection of exhaust steam or live steam, if necessary.

It is, therefore, possible to heat the air in the drying chamber to any necessary degree of temperature, and, by regulating the velocity of the blower, give it sufficient force to carry the load of moisture out into the open air. It may be well to mention the fact that the drying chamber is divided into two sections, in one of which the bodies are dried, while the other accommodates the hats ready for the front shop.

On each floor there are doors opening into this drying room, so that the hats may be put in or taken out whenever or wherever they are wanted.

From the standpoint of mechanical progress this drying apparatus is quite the most interesting thing in the factory.

FRONT SHOP

The soft hat finishing department occupies the entire fourth floor of the front shop wing, the hats being delivered there by the apparatus in the drying chamber. This room, 280 feet long by 40 feet wide, contains all the soft hat processes beyond those of the make shop. From here they are delivered direct to the packing room on the ground floor by elevator at the extreme end of the building. The processes follow one another in this room as elsewhere, so that the hats always travel forward. Heat for the shells, flanging bags, curling and ironing machines is given by electricity; an advance over common practice that is sanitary and, moreover, economical when the current is "home made," as it is in this shop. Other items of a mechanical nature are similar to those generally in use in modern nat factories.

The stiff hat front shop occupies two entire floors of this wing. The stiff finishing room is on the third, while matricing, curling and stiff hat trimming rooms are on the second. The hats are conveyed from one part of each room to the part devoted to the next step in their manufacture, and from the third to the second floor by overhead endless-chain conveyor.

The empty racks in the packing room are also placed on this conveyor, which conveniently passes along the ceiling of the first floor, through the floor of the trimming room, and thence to the fourth floor.

The hats are taken from the trimming room to the packing room on the elevator that performs a like service for the soft hat department.

PACKING ROOM, ETC.

The first floor contains a fully-equipped machine shop, printing and band box factory, packing case factory, and finally the packing and shipping room. A door at the extreme end of this floor opens on a private switch, where the cases may be loaded on the freight cars at leisure, which, of course, does away with by far the greater part of the usual cost for cartage.

This marks the close of the processes of manufacture in the Lee-McLachlan Company's plant. We have, we believe, set forth the salient features of the subject under discussion as briefly and as thoroughly as possible for the readers of this treatise who are, for the most part, unfamiliar with the technicalities of hat manufacture, mill construction and mechanical appliances. But we would hardly be justified in ending this chapter without some reference, even though necessarily brief, to the provisions for the comfort and safety of employees. We have referred to the use of direct-driven machinery, that so completely does away with the danger from belts and shafting. We also referred to the especially efficient methods employed to ventilate the entire plant and to remove the steam from the plank shop, and also to the excellent drainage of the plank shop floor. The window space in all departments provides a maximum of light and air. The windows are each in two sections, an upper and a lower, and each section swings open or shut on a horizontal axis, the resulting aperture being adjustable according to any desire or necessity. The building being but forty feet wide is flooded with light. Each depart-

ment is furnished with one or more wash-rooms, fitted with ample facilities for washing and dressing. There are many closets of the best design, and in these, as elsewhere, open plumbing assures perfect sanitation. Elevators are provided, with heavy self-opening and self-closing trap doors, and the starting apparatus is self-locking. Even the stairs are placed at an angle that assures safety as far as possible, even though at the expense of a little space. The whole shop seems to be planned with a view to the conditions affecting the workmen, their reasonable comfort and satisfaction, while engaged in their daily labor.

II

Hatters' Fur and the Blowing Room

NO doubt everyone who sells hats knows that they are made of fur, principally of rabbit fur, but few not directly connected with the manufacturing branch of the trade can appreciate the importance of the different phases of the fur question to the hat manufacturer. The fur of each variety of fur-bearing animal produces a different result, when worked into felt, from other varieties. Different lengths of the fur fibre, even though taken from the same animal, produce different results. The same thing is true of fur fibres of different diameters, or those taken from different parts of the same skin or from the skins of animals of various ages, or caught in different lands, localities, latitudes, and altitudes. Even the manner of killing the animal, the length of time it is dead before skinning, and the time the fur is kept in certain conditions of temperature and humidity all play an important part in the "workability" of the fur and in the final result.

The business of preparing fur for hatting purposes, is, in reality, a separate and distinct industry and should be discussed in an article devoted exclusively to that subject which is as broad as the subject of hat manufacture and also intensely interesting. We shall not attempt to describe the treatment of the fur in this article but only refer briefly to some of its features.

The fur used in hatting is, as we have said, principally that of the rabbit or "coney." Hare's fur is the most important, while nutria

and beaver are used in the finest grades, the latter rarely used at all nowadays, although formerly it was the chief constituent of all good felt hats.

The supply of rabbit fur comes from Great Britain, Australia, Tasmania and New Zealand principally. Hares come from Europe—France, Belgium, Germany, Austria, Russia and Northern Italy. Nutria is a relative of the beaver living in South America, while the chief source of the very limited supply of the true beaver is in Canada. Other furs also used include seal, mink, muskrat, etc.

The fur is treated, while still on the skin, with nitrate of mercury. This process, which is known as "carroting," is employed to open out the texture of each fibre and thereby render it better suited for felting. A fur fibre is not the smooth cylindrical tube it appears to the naked eye. Under a microscope it has the appearance of a number of table glasses set each within the other, the rim of each section being uneven, but the unevenness being similar in all fibres of the same variety. The nitrate of mercury eats away the oil or grease on each fur fibre and opens out the "rims of the cups." This is necessary because felting does not consist alone of the *interweaving* of fibres but also of their *interlocking* by means of these projecting flanges on each fibre.

From the fur factory each variety of fur is delivered to the "blowing room" of the hat factory in paper bags, containing exactly five pounds of fur. As the price of fur, as of all commodities, depends upon its supply as related to the demand, the scarcer varieties are the

THE BLOWING ROOM

more costly and, in consequence, it is the aim of the hatter to mix the various kinds of fur in such proportion as to give the desired result at the least possible expense. Success in hat manufacture may be said to depend to some extent on one's skill in making mixtures of fur. Even the *color* of very light shades is dependent upon the fur mixture to such a degree that a man might be an excellent chemist and color mixer, thoroughly familiar with every detail of the theoretical aspect of dyes and dyeing, but unless he had a thorough knowledge of fur mixtures, indeed of the very mixture in the hat he was trying to dye, he would be unable to obtain the desired color effect except by accident or tedious and costly experimental work.

When the manufacturer has decided upon the mixture the different furs are placed in layers in a bin, after which they are sometimes thoroughly mixed with a fork. Every effort is made to insure a thorough mixing of the various grades and kinds of fur. From this bin the roughly mixed fur is transferred to a mixer consisting of a large box, partly wire screened, containing toothed cylinders revolving at terrific speed. These teeth not only toss the fur about, mixing it thoroughly, but also tear the individual fibres apart from one another.

The "blower," the next machine in the order of procedure, carries forward the process of mixing and separating and, in addition, it cleanses the fur, removing all dirt and dags. A blower is divided into a number of sections, each section being a complete machine in itself, performing its own service and passing the fur on to the next section. Years ago hatters were not as particular about this process as they

are to-day; they did not appreciate the advantages to be derived from thoroughly refining the fur. Six sections were then considered as quite sufficient for all practical purposes. To-day from twelve to forty sections are used. All these sections may not be in one machine. In the Lee-McLachlan factory 208 sections are used in order to mix and clean the fur to the last degree, by machines ranging from six to sixteen sections. As this process is highly important it is worthy of description in detail.

After the fur is removed from the "mixer" it is fed into a hopper from which it falls upon an endless belt conveyor. Two corrugated rolls of small diameter pick the fur from this conveyor and pass it between them to a toothed cylinder of much greater diameter that revolves at a very high speed. Its velocity is so great as compared with the speed of the two small rolls that slowly turn the fur into the compartment, that the fur fibres are torn apart and tossed to the top of the section.

As the fur is tossed to the top of the compartment or section of blower the heavier particles at once fall back. In falling they pass between the toothed roll or "picker" and a second conveyor through a space a few inches wide. This heavy matter is composed largely of dirt, very short fur, carrot dags, skin dags, etc. Carrot dags, which by the way are much more numerous than skin dags, are very hard to separate. As they are formed of two or more fur fibres stuck together at one end by the carroting solution they present a surface to the air currents out of all proportion to their weight, acting on

FIVE POUNDS OF FUR READY TO BE BLOWN

the principle of the aeronaut's parachute, and are carried onward with the clear fur. Their removal depends almost entirely upon the action of the toothed rolls, which may be depended upon with reasonable certainty to tear apart the recalcitrant fibres if the blowing process is carried through enough sections. This difficulty is experienced in the greatest measure in the case of carrot dags of hares' fur, the wavy nature of which makes it all the better parachute. Very few skin dags pass through the blowers without being separated from the clear stock.

As the refuse falls through the narrow space and out of the blower the lighter fur is carried onward by the air currents set in motion by the revolving cylinder, and, eventually falls upon the second belt conveyor after passing over the narrow waste passage. The second belt carries it to two more small corrugated rolls which feed it into the second section, and so on.

In order to facilitate the blowing process it is necessary to keep the temperature in the blowing room rather high. If the air is too cold the fur fibres cling together and effectually resist every effort to separate them from one another. To get an even, smooth felt it is absolutely necessary that each fur fibre should be separate from all others.

Each section of the blower is covered with wire screening of quite fine mesh. This is used in place of some tight covering because it permits of the free circulation of the air within each section and obviates the danger of cyclonic air currents that would certainly form

in a closed compartment and result in the failure of the purposes of this machine.

Now while it is necessary to keep the room warm it must not be of a dry warmth, for when the air becomes too dry, finer particles of fur work their way through the wire mesh, making the room most uncomfortable and causing serious loss from waste. A steam pipe heats the room and, when occasion requires, steam from this pipe is allowed to escape into the room, thus adding moisture to the atmosphere. Too much moisture in the air would be quite as disadvantageous as too little. Dry fur will absorb moisture until it becomes so heavy, in proportion to its bulk, that it is practically impossible to blow it. Moreover the moisture upon the surfaces of all the fibres forms a bond that holds the mass together. It is, therefore, absolutely necessary to keep the temperature and humidity of the blowing room under careful control. In this factory a considerable economy is effected by using the waste steam from the plank shop (which is on the floor below), for the purpose of regulating the temperature and humidity of the blowing room.

When the fur has been thoroughly blown, when each fibre has been separated from all the others and the dirt and dags have been removed as completely as possible, the manufacturer finds that he has purchased a quantity of material which has a very limited value. However, much of this refuse may be returned to the fur factory and worked up into short stock by special treatment.

BIN OF BLOWN FUR JUST AS IT LEAVES THE BLOWERS, AFTER HAVING BEEN THOROUGHLY MIXED AND REFINED

III

The Forming Room

IN the last chapter we described the mixing and refining processes by which the fur is prepared for the felting process. Felt differs from woven fabrics in that it is made up of fibres that are interwoven and interlocked by means of their lateral projections, and each fibre thus interwoven and interlocked with other fibres, whereas in the woven fabric the fibres are merely interwoven by groups; that is to say, the fibres in woven fabric are twisted into threads and the threads are interwoven. As in a woven fabric, the groups of fibres are only connected by interweaving, and are, moreover, arranged in groups either parallel or at right angles to each other, a woven fabric may be torn apart along a straight line, while the felt fabric, consisting of fibres going every which way, each interlocked as well as interwoven, with a number of other fibres, cannot easily be torn along a straight line, and if torn or cut cannot be brought together again.

As the felt fabric consists of fibres interwoven at every possible angle, its surface presents a smooth, unmarked appearance; there are no parallels or right angles, no designs or figures apparent. Consequently there is no need to cut the fabric "to match" in making a hat or any other felt article. It is therefore not only possible, but even necessary, to start the work in the general form that will appear in the completed article. When the fibres are once thoroughly interlocked the shape of the mass cannot be greatly changed without

destroying the fabric. For this reason the fur fibres are first joined together in the shape of a cone, that being the form most nearly approaching in similarity the rough outlines of a hat.

Passing from the blowing room in bins, as previously described, the fur is taken to the "forming mill." In the Lee-McLachlan factory the forming room is 165 feet long by 40 feet wide, containing 16 formers, each having a capacity of from 50 to 60 dozens of medium and fine fur felt hats per day. These formers are placed in a row down the centre of the room, a wide passage behind them affording ample space for the fur bins and along the other side of the room, in the light by the windows, the "hardeners" have their benches.

In this factory the formers are run by electric power, individual motors, and for reasons of practical economy an especial study was made of the "varying load" problem involved in this instance. Stated in its most elementary form, the problem is this:—"If a fan can pump a given number of cubic feet of air through a given number of holes in a given period of time, it will require less power to draw the air at the same velocity through a lesser number of holes or through the same number partially closed by an overlying layer of fur fibres. This being so, it follows that if the power exerted remains constant then there must necessarily be considerable waste of power during part of the operation." The solution of this problem and the adaptation of the machinery to the results attained by the investigation, means a saving in the coal bill, and consequently in the cost of producing each hat.

THE FORMING ROOM

To return to the forming process, the mixed and blown fur is now weighed out and placed in boxes consisting of twelve sections or compartments, each section holding the allotment of fur for one hat. This box is carried to the feeder of the "forming machine," who feeds the fur as evenly as possible and at regular intervals upon the apron of the former.

From the apron of the former the fur passes between two small corrugated rolls, to be torn and tossed by the teeth of a large roll, as in the blower, but instead of falling back upon a belt conveyor it falls into a closed compartment containing a perforated copper cone upon which it is drawn by means of an exhaust fan placed beneath the machine. The general processes of forming stiff or soft hats do not vary to any great extent, but owing to the absence of any great quantity of stiffening in the soft hat its shape is maintained by the strength of the felt itself. The shape of the crown, which is nothing more than an infinite number of arches bound to each other, gives strength to that part of the hat. The lateral stress upon the part of the hat which encircles the forehead is taken up by the sweat leather on the inside and the hat-band on the outside, so that its permanency is secure. But the brim is subjected to stresses from which it has no protection. Its own weight tends to bend it downward, and it is in almost constant use as a "handle." The wider it is the greater is the leverage and the more severe the stress. Some shellac may be used to help in this respect, but hardness is a quality

that must be avoided at all costs. It is necessary to use more fur in the brim than elsewhere. This is a delicate problem, taxing the skill of the foreman of the forming room to the utmost.

To get the fur distributed upon the surface of the cone from apex to base is not a simple matter. The fur naturally tends to fall perpendicularly from the top of the compartment, where it enters to the floor, but the air currents due to the suction of the exhaust fan deflect the fibres from their natural course. In the closed compartment the direction of the air currents is from the top diagonally downward to the cone. To distribute the fur just where it is needed it is necessary to control the force and direction of the air currents. This is done by setting up cross currents. In the sides of the compartment there are a number of windows that may be opened or closed by slide shutters. By experiment the coner, or rather the foreman of the forming room, learns just how much to open these slides and which slides to open in order to accomplish the purposes he has in mind for his hat body.

After the cone has received its covering of fur the coner opens a door in the side of the compartment and quickly but very carefully lays moist burlap over the top of the cone, while another piece is wound about its sides swathing it from tip to base in damp burlap. These cloths are cut to fit in order to avoid creases and wrinkles. Over all the operative slips an inverted funnel. He then lifts the cone and its coverings from the compartment, places it upon a frame and lowers it into a vat of warm water. It remains there until automati-

THE FORMER OPEN

Showing the Revolving Copper Cone with a Covering of Fur it has Just Received, also the Windows for Regulating the Air Currents

cally raised. As both the copper cone and the funnel are perforated the fur between them is thoroughly soaked in the warm bath.

The coner now lifts off the inverted funnel, turns the cone upside down and slips the fur coating off with the ends of his fingers.

The felting process had commenced the moment the cone was lowered into the vat of warm water. When the fur cone was absolutely dry the fibres had not interlocked their scales. A careless touch with the fingers or a dash of water will easily separate the fibres in the fabric at that stage. Upon being dampened they are bound together to a certain extent by the molecular attraction of the films of water with which each fibre is covered. This bond is, of course, extremely weak, but it is appreciable, nevertheless. When the fibres feel the effect of the heat and moisture they expand, not much, perhaps, but enough to make them travel far enough to interlock their scales here and there with the scales of other fibres. If the body should be dried out thoroughly at this stage it would be found to have greater strength than it had before its immersion, but not enough to permit of its being handled. The fibres must be interlocked still more. The body must be "hardened."

HARDENING

The "hardener" is the next man to carry forward the work. As we have indicated, the hat is now a cone of fur some three feet high, about two feet in diameter at the base, and held together by the weakest bonds imaginable. It must be reduced in size and its differ-

ent particles so thoroughly interlocked that the most severe treatment could not again separate them. This is a shrinking process—nothing more—and is accomplished by means of hot water and compression. But at the first stage the cone is so delicate that it must be handled with great care, and, very naturally, the process of shrinkage is conveniently divided into several separate operations.

The hardener, working at a bench behind the forming machines, carefully sprinkles the fur cone with hot water from a brush, and, wrapping it in a cloth, rolls it this way and that for a few times, always with extreme care that the delicate structure should not become separated. He opens it out and examines it for imperfections, dags (pieces of skin or matted hair) that have escaped the blowers, weak places in the cone where the coating has been unevenly distributed or the fur become separated in handling. These he must attend to. If the dag is found it is removed with the fingers, or sometimes a pair of tweezers. If a thin spot shows, the hardener picks up a little fur from the stock he has at hand, lays it upon the weak place and gentle but firmly taps the patch with the bristles of a stiff-haired brush until it is evenly worked into the body. When the hardener is through with his work the cone is still very tender, but it has knitted more closely together and has some strength. It then passes into the sizing room.

THE FORMER CLOSED

The Operator is Resting his Left Hand on a Funnel that Covers the Cone Upon which the Fur has Been Drawn by Suction. On the Bench in Front are a Number of Bodies in Their First Stage of Shrinkage

IV

The Sizing Room

THE sizing room is the first in which there is a radical difference between making soft and stiff hats. Consequently, in the Lee-McLachlan factory one room on the first floor is devoted to stiff hat sizing and one on the second to soft hat sizing.

The starter now takes his turn in the manipulation of the cone. "Starting" is almost universally done by hand, although in a few factories machines are used. The starter does nearly the same work as the hardener, but instead of sprinkling the cone he rolls it in a cloth and dips it into a tub or kettle. In fact, the difference between his work and that of the hardener is merely in the vigor with which he goes about it. He applies less care and more "elbow grease." The machine used is simply the sizing machine minus the compression roller, the cone rolled up in its cloth being tumbled about a few times upon two wooden rollers of larger diameter than in the sizing machine, revolving in opposite directions. The motion knits the fibres more closely together.

After the starter has shrunk and strengthened the body somewhat it passes into the hands of the sizer. He does practically the same work as the starter, but in a still more vigorous manner. He kneads and dips and rolls the cone with apparently little regard for the result. But nevertheless he must watch his work with the utmost care. He must roll it from every direction to keep an even thickness throughout. He must stretch it over his hands at frequent intervals

to prevent opposite sides from felting together. Little lumps of matted fur, or hair worn from the surface of the hat bodies during their manipulation, are again caught upon their surfaces as they are lifted from the water, and, unless detected and removed, they will appear as surface dags. If opposite sides felt together even for a few minutes without detection, a mark will appear on the finished hat, commonly called a "streak" or a "lightning rod." During this process the careless workman lays the foundation of future trouble in all departments. In fact, flaws enter into the hat here in spite of every painstaking effort, and in many cases they cannot be detected until the hats have passed through several more processes, with a consequent loss of material and labor.

There are some minor differences between soft and stiff hat sizing. For instance, in soft hat sizing the body is worked as much on one side as on the other, because, unless it has left the finishing room, it is reversible, owing to the absence of stiffening in the crown. Less care in this respect is necessary in the case of the stiff hat, for, once it is stiffened, it cannot be turned inside out. The soft hat sizer must also keep in mind the difference in thickness from crown to brim, and must perform his work not only with a view to preserving this difference, but also to accentuate it, or at least to increase the strength of the brim by interlocking its fibres more thoroughly than is necessary in the crown.

The work is not only exacting in regard to the degree of skill which it calls for, but it is trying on account of the necessarily humid

STIFF HAT SIZING ROOM

surroundings. In the back shop, as it is called, there is always, before everything, a superabundance of moisture. Under certain atmospheric conditions the steam from the vats of hot water so completely fills the room that it is practically impossible for one not thoroughly familiar with the surroundings to find his way about without danger from machinery and belting. Exhaust fans are used, and, if of sufficient capacity, they have an appreciable effect upon the amount of steam in the rooms. In the modern factory the use of individual motors for each machine is rapidly supplanting the shaft and belt system, and, of course, this reduces the danger from that source. This is especially true of the Lee-McLachlan factory, where electric power and individual motors are used wherever their use is possible. A most recent improvement, known as the Sturtevant system, is said to work very well in keeping the room free from steam. Reference to this system was made in the first article. It consists of a large blower, motor-driven, that draws air from the outside of the building through coils heated by exhaust steam from the engine, and forces it through conduits to convenient parts of the building. This hot, dry air is admitted into the sizing room near the floor. A return series of conduits with orifices near the ceiling takes the moisture-laden air out of the building. By regulating this system according to the requirements of temperature and humidity, the sizing room may be kept comparatively free from steam, no matter what the weather conditions may be.

In spite of the steam and water, or rather because of them, it is

a fact very generally accepted that many of the sizers live to a very old age. Indeed, the oldest men in the factory may be found in the sizing room. The reason of this is very simple. In this room there is absolutely no dust or fur floating in the air. It is the only room in a hat factory where this is true. If a speck of dust or a piece of fur gets into the room it immediately becomes heavy with moisture and falls to the floor. Thus the steam which would otherwise be an unmitigated nuisance does valuable service in keeping the air pure.

To return to the subject. We have discussed the hand method of sizing, but the sizing machine is a far more important consideration in modern hatting than the hand method. In machine sizing the work is conveniently divided into three stages. In the first stage the body is alternately dipped in the kettle and rolled over and over, not rapidly, upon two parallel wooden rolls. This is just a step above the starting process, and the machine is in reality a modified form of the starting machine. The main difference between the two is in the size of the wooden rolls (which is much less in the sizing machine than in the starter) and in the speed with which these rolls revolve (the sizing machine running more rapidly than the starter). From this sizing machine the body is passed to a second, which differs from the first in that it has a third roll, placed above the other two, pressing lightly upon the body as it is tumbled about. In this machine the speed is considerably advanced. "Lags," wooden cleats fastened to the rolls, serve to prevent the body from slipping, thus making it revolve, and also, by striking the felt with great rapidity, impart

some of their energy to the fibres, which consequently travel more readily. The third machine is like the second, but is run at a greater speed. Usually the lags are modified on the third roll of this machine, being a number of curved cleats winding around the roll. A section cut through the cleat and roll would have the appearance of a distorted disc. These cleats, if they may be so called, give the body a wabbling motion.

The pressure, whether applied by hand or by machine, has the same effect in working the fibres more closely together. The action is comparatively simple. As the pressure is applied each fibre is bent slightly. When it is released from pressure, or when the pressure is applied in another direction, the fibre straightens out. But its scales prevent it from moving except in the one direction—towards its root—and consequently it moves in that direction about half as far as it was bent out of true. This advance would be in a straight line, approximately speaking, if the root end of the fibre met with no obstacle; but in practice it meets with one obstacle after another. Following the line of least resistance, it passes over one fibre, under another, turning this way and that, until it is closely interwoven with the other fibres. This is, of course, especially true of the longer fibres, upon which the strength of the felt is dependent. But the more firmly these are interwoven the firmer grip they have upon the short stock. The short stock is also held to the long fur by the mutual interlocking of the scales on their fibres. You see that, while we may speak of the weaving together of the fur fibres, it is not the

weaving that is understood in the case of woven textiles. In the latter there is no felting to speak of, no interlocking of fibres.

A peculiarity of the sizing process is the variation in the amount of effort required to felt bodies of different compositions or mixtures. Although the finer furs, because of the prominence of their scales, may "start" more readily than the lower grades, they are more difficult to advance beyond the starting point. It is upon this question that the scale of prices for piece-work in the sizing room is based. The cheapest hats—those composed of the poorest stock—can be sized with less effort and with greater rapidity than the better grades, and consequently, the sizers receive a lower price per dozen on such work. This often leads to differences of opinion between the workmen and the employers.

After the bodies have been sized to the proper height and thickness they are "pinned out." The pinning-out machine consists of a revolving cone upon which the hat body is placed, and a second cone (of much smaller diameter at its base and shaped somewhat like a druggist's pestle) that presses against the outer surface of the fur hat body. As they revolve these two cones squeeze most of the water from the felt and the smaller acts as an iron. This wet ironing gives the felt a more uniform thickness, smoothes the surface somewhat, and gives the body a size more nearly exact than it is possible to give it in the kettles. Another pinning-out machine consists of a revolving cone upon which the hat is placed, and opposed to it a revolving disc, which takes the place of the second cone, described above.

SOFT HAT SIZING ROOM

The hats are now placed in whizzers or centrifugal extractors and dried by the simple process of revolving them so fast that the water flies off at a tangent, leaving them practically dry.

In the Lee-McLachlan plant unusual attention has been given to the floor drainage. The presence of so much water, as the nature of the work in this department requires, means "wet feet." There is no way to avoid *that* inconvenience. But it can be mitigated, and it *is* in this factory, the floors being of concrete with sunken drains running the length of the room and the workmen standing upon raised gratings as they work. Still the plank shop is no place for patent leather pumps, and, as the illustrations show, "dressiness" is not one of the considerations that weigh heavily on the minds of the journeymen during working hours. A shirt and drawers, a coarse apron of rubber-coated duck, a pair of woe-begone shoes with holes for the water to run out of, and a cheerful disposition are all the essentials to a sizer's equipment.

V

Shaving, Etc.

AFTER the hats are sized they are "shaved." The protruding fibres, that give the body a hairy appearance, are cut off by passing the hat body over a cone-shaped roller that brings the felt in contact with rapidly-revolving knives.

After shaving, the finest hats, and especially the finer soft hats, are returned to the sizers for further manipulation, but that is seldom done in the case of stiff hats.

The edge of the fur cone is, as yet, quite uneven. The bodies are, therefore, "rounded in the rough"—that is to say, they are passed between two circular knives that trim off the irregularities. The roundings—the waste from this process—are sent to the fur factory to be cut up into short stock.

For the purpose of future identification the bodies are notched on their edges, the number of notches indicating the size of each body. This was formerly done with shears, but there are one or two machines designed to perform the work more rapidly, consisting of a number of V-shaped steel punches, which cut out the felt.

DYEING

Probably no branch of the hatting industry has undergone a greater change during the last twenty years than has taken place in the dyeing department, and probably no part of the work is so much a matter of guesswork. With the displacement of logwood dyes by

the anilines and alizarines, the time consumed in the dyeing process has been greatly reduced, the process simplified, the variations in color greatly increased and a better control over the results has been established; but the solution of the various problems has not been reduced to an exact science by any means. With all the advantages of modern methods, and in spite of careful study on the part of both chemists and manufacturers, dyeing felt still possesses more mystery than certainty.

No doubt to the person who has given the matter little or no thought the dyeing of felt may appear to be as simple as painting a fence, but this is far from the truth. It is, of course, a simple matter to mix dyestuffs of several different colors and obtain the desired shade. The difficulty arises when you attempt to impart that shade to the felt. The dye makers furnish the hat maker with sample books of dyed felt, accompanied by the formula for each color mixture represented therein, but they cannot safely guarantee that all felt dyed according to their recipes will come out according to sample. Differences in fur mixtures—sometimes differences that are scarcely appreciable—make each attempt at dyeing a matter of experiment. The transparency of colors has much to do with this, as the natural colors of the fur fibres shine through and mingle with the colors of the dyestuffs, producing unexpected effects sometimes.

Again, the dyestuff undergoes a chemical change upon coming in contact with the fur felt under certain conditions. The presence of lime, manganese and other mineral substances in suspension or solu-

tion in the water of the dye vat, or deposited upon the fibres of the filterlike felt bodies in the sizing kettles, also affect the dyestuffs, and, as the nature and quantity of these water ingredients are ever varying, they naturally make the dyeing problems extremely perplexing. The presence of what we consider muddy water would make it quite impossible to dye the lighter shades, while vegetable and mineral matter in quantities barely appreciable to the casual glance will cause a waste of the dyestuff.

Entirely apart from these problems there is the mechanical part to consider, and this is subject to all kinds of variation. For instance, some colors are obtained more satisfactorily if applied after the bodies have been stiffened, although as a rule the dyeing precedes the stiffening process. Again, if the hats are to be dyed a strong color—black, for example—they may be placed in vats of large capacity and stirred mechanically by means of slowly-moving paddles. If, however, they are to be given one of the extremely delicate shades so often wanted in the soft hat, they can be placed in vats containing only a few bodies at a time, for their submersion in the dye bath beyond the exact time in which they absorb the proper amount of color would mean that the color would be intensified or deepened. In this case it is necessary to pole the bodies by hand and watch them with great care.

It would hardly be worth while to go deeply into the subject of dyeing in this book; it is extremely technical, and in order to treat it in anything but the most superficial manner it would be necessary to devote more time and space to it than is practical for the present pur-

pose. Doubtless the great beauty and variety in the coloring of the hats to-day lead us to expect and demand the impossible. The writer will be content if he has impressed upon the reader the fact that fur-felt dyeing is an infinitely complex matter.

In the Lee-McLachlan factory black dyeing is done on the first floor, while the colors are dyed on the second, to avoid the troubles that result from too close a contact with black materials, dye-stuffs, etc.

Stiffening of Stiff Hats

The hat body, still conical in shape, is now stiffened. The process, while quite simple, is most interesting, as it brings up at once a series of problems belonging strictly to the making of stiff hats and upon which the profit in hat manufacture is highly dependent. Obviously it would not do to use a material for stiffening that would harden in lumps or ridges. Something must be used that will enter into the body of the felt smoothly and evenly. Moreover, as the hat must, in time, be exposed to all kinds of weather, the material used for stiffening must not be readily soluble in water of a temperature usual in rain water. Shellac is used for this purpose, and, unfortunately for the hatters, no substitute has ever been discovered. The unfortunate part of it is the fact that shellac is a product of India alone, and its supply is in no way keeping pace with the increasing demands for this substance in the arts. Its cost is, consequently, subject to sudden and violent fluctuations, and forms one of the hazards of hat manufacture that frequently turn profit into loss. There is only one sat-

isfactory solvent for shellac. To be sure, in the old-fashioned water stiffening process the shellac was dissolved in hot water; but the process was very slow and quite unsuited to modern conditions. Denatured alcohol is the solvent now in use. The shellac is stirred into the alcohol until the solution is of the proper consistency, the proportions depending upon whether the stiffening is to be done by machine or by hand, and also upon the requisite degree of stiffness. In the hand process the hat body is dipped into the solution and then withdrawn. The operative using a brush or a "jack" scrubs or rolls the gum thoroughly into the felt. The machine used to accomplish the same purpose consists of rollers between which the hat passes, the rollers and a brush (through which the solution is applied to the hat) working the gum into the felt. The machine can be so regulated that more stiffening can be given to the part of the body that will become the brim.

Taken from this bath, the hats are placed in ovens provided at the top with orifices through which the alcohol, vaporized by the heat, passes into a condenser. In the condenser it is again changed into liquid form, to be caught, refortified (the water taken out of it), and used again. With the substitution of grain alcohol for the wood alcohol the danger to health that attends the use of the latter has become a thing of the past. The discomfort and the various eye and throat troubles common among men working with wood alcohol have been experienced in the hat trade in the past probably more than in any other industry.

time, in order to dissolve it completely. This solution is of much lower specific gravity than the former. It is very liquid, running almost as freely as water. After its application and the subsequent drying of the body the shellac is not found in very great quantity in the felt, and merely serves to give some resilience to the brim.

There are two machines in use for the application of the stiffening solution to the soft hat brims. The older invention consists of two revolving cylinders overhanging a vat containing the solution. The operative dips the body into the solution with the utmost care that only that part which is to become the brim is submerged. This calls for a clear eye and a steady hand. He then inserts the tip or apex of the conical body between the revolving cylinders, and, as it is drawn upward between them, the surplus solution is squeezed out. The felt, for some reason not fully understood, repels the solution; it seems unwilling to absorb it. Sometimes, therefore, the body may require several immersions in the liquid before enough of the solution is absorbed to affect the required result. In this process the alkaline solution, coming in contact with the hands of the operative, is very apt to make them sore. The sal soda attacks the oils of the skin until it scales off in spots down to the raw. This trouble is somewhat lessened by a later invention.

The second machine is in many ways a great improvement over the old one. It consists of a feed tank containing the shellac solution, two rolls between which the brim is passed, and a receiving tank from which the solution not absorbed by the felt is pumped back into the

feed tank. The latter is placed upon a level a little above the body of the machine, so that the solution will run from it freely, by gravitation, through a pipe to a point just in front of the two rolls. The brim part of the body is inserted between the rolls, a guide being fixed in a position that permits only the desired part of the felt to be exposed to the solution, and the solution is allowed to play upon it until enough has been absorbed. Experience teaches the operative just how much is needed in each body.

After stiffening, the bodies are allowed to dry, and are then placed in a steam-filled box for about twenty minutes to be cleared. The hot steam dissolves what little shellac there is in the outer surfaces of the felt, and the stiffening is concentrated through the central section. In the Lee-McLachlan factory the stiffening room is on the second floor.

The use of alcohol as a solvent is, of course, attended with considerable fire risk. As a rule, manufacturers are obliged by the insurance companies to separate their alcohol-using portion from the rest of the plant or suffer a very considerable increase in their insurance rates. In the Lee-McLachlan factory the denatured alcohol is brought to the premises in tank cars and from these conducted by gravitation through pipes to a 15,000-gallon tank in the yard. The shellac is cut, or dissolved, in the stock house, which is one of the separate buildings of the plant. From this stock house the shellac solution is pumped to the stiffening room every morning, and at night the unused portion is pumped back to the reservoir in the stock house.

The alcohol recovery plant is on the second floor, in a room separated from the rest of the building by fireproof partitions. As soon as the recovery ovens accomplish their work the alcohol is pumped to a second 15,000-gallon tank placed beside the first in the yard. It is then refortified at the convenience of the concern.

There are several factors tending to give this system an advantage over the usual practice. In the first place, the receipt of the alcohol in tank cars instead of in barrels and its delivery on the spot where it is to be stored reduces the cost directly. In the second place, the fireproof construction of the recovery department and the removal of all surplus stiffening solution from the premises excepting during work hours reduces the fire hazard, and, as a result, cuts down the insurance rates to a minimum. As insurance rates on hat factories, as a rule, are heavy, this is an extremely important factor in the cost problem, and Messrs. Lee-McLachlan have, apparently, been successful in eliminating this in a very large measure, as far as their plant is concerned.

VI

Tip and Brim Stretching and Blocking

NOW the hats are to be put through the several processes whereby the first rough outlines of the crown and brim are to be given to the bodies, until now conical in shape. The stiff hat is dipped in hot water to soften the shellac stiffening. The tip stretcher consists of two metal stars, one above the other. The upper star is stationary, and as the lower one moves up and down the fingers or rays of the upper one pass between the corresponding rays of the lower. The cone or hat body is drawn over the lower star. As the lower star ascends, the felt is forced between its rays and is stretched in scallops. In the brim stretcher the same principles are involved, but the stars are so arranged that only the lower part of the fur cone, or what is to be the brim, is forced between the rays and stretched.

The body is now bell-shaped.

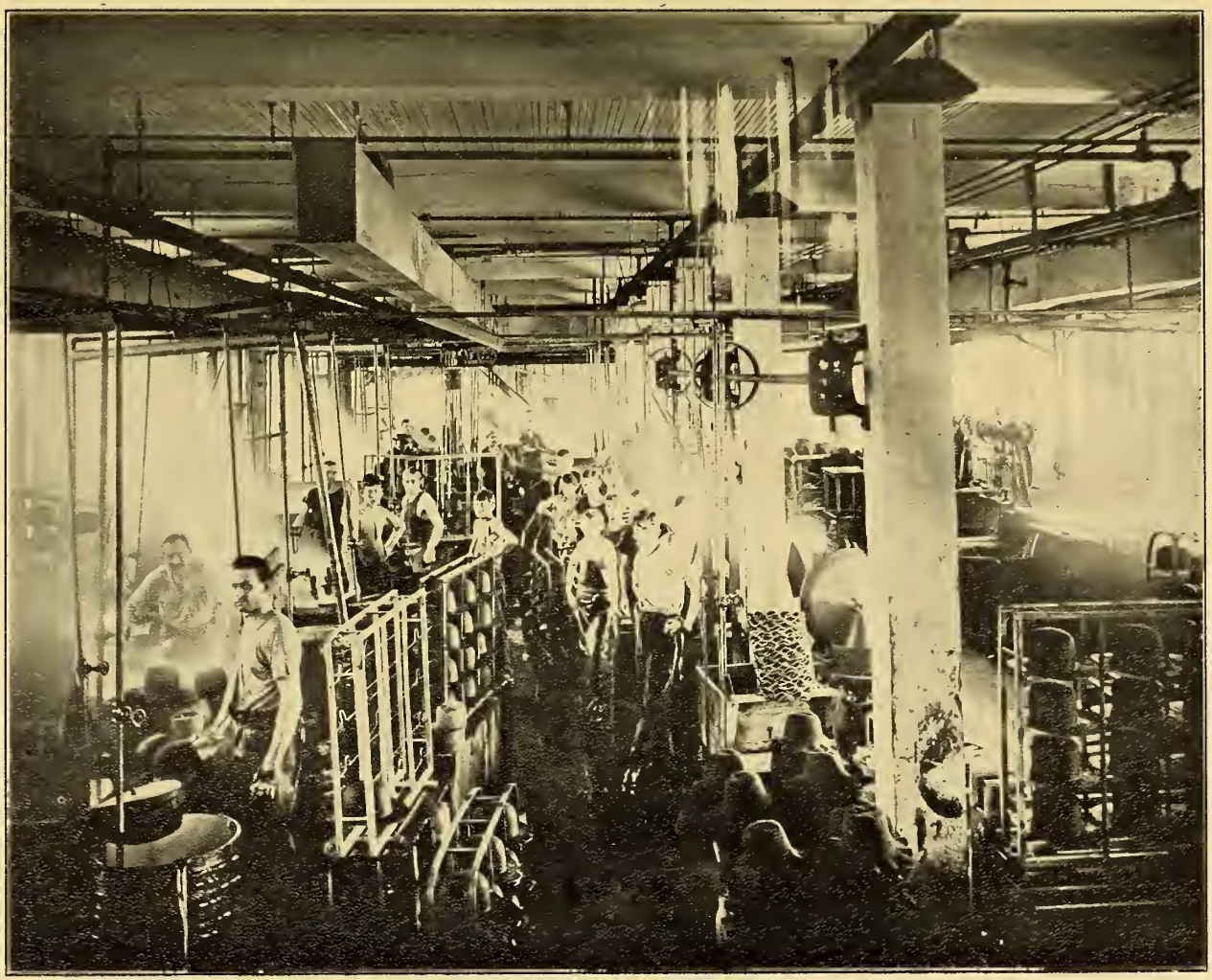
Now follows the "wet blocking" or "blocking out" process. In the Lee-McLachlan factory the blocking is done by hand, as it is held that machine blocking puts more strain on the bodies than they should be given at this stage. Hand blocking preserves the texture and allows the body to retain its natural strength and smoothness. In machine work the body is drawn over a metal block made up of a number of separate fingers or levers, each lever forming a small segment of the entire circumference. The block is encircled by a rubber pad, so that the pressure on the felt when the fingers are spread

out will be more evenly distributed. Metal fingers grasp the edges of the body and pull downward and outward, stretching the felt over the block, and at the same time widening the bell. A metal collar, swinging on a hinge and worked with a lever, is brought down over the block slowly and gradually, so as not to break the felt. This collar fits closely to the block, and, as the edge of the body is held firmly on all sides, the felt is stretched to conform to the shape of the block. The levers of which the block is composed expand and stretch the crown as required. A bucket of cold water is now poured over the body, cooling it off and hardening the shellac. When the hat is lifted it has a crown and brim, but the crown is not as yet of the proper dimensions.

The hat, somewhat softened by steam, is now placed on a wooden block. The operative, taking up a tool adapted to the purpose, presses firmly against the felt, following the rough angle between the crown and the brim. This sharpens that angle until it is of the proper 90 degrees. This operation also moulds the crown to a shape and size closely approximating that to which it must conform in the finished hat.

The tip and brim stretching and wet blocking processes in soft and stiff hat making are very similar, and a separate description of each would be needless repetition.

The hats, still wet, are placed in centrifugal extractors, or whizzers, which, revolving with great rapidity, force out the water. These whizzers remove the greater part of the water from the hats, but



HAND BLOCKING, ETC.

if they were run so fast that every particle of moisture was driven out of the bodies the chances are that the felt itself would suffer in its texture. It is necessary to dry them by a gentler process.

This is accomplished in the Lee-McLachlan plant by placing the bodies on racks which travel up and down on an endless chain conveyor through a heated compartment.

The mere application of heat vaporizes the moisture, but what to do with the *vapor* has always been the serious problem that presents itself at this stage of hat manufacture. It is evident that in a confined space containing a large quantity of wet hat bodies the application of heat would merely at first saturate the air with water vapor, and then, when the air became thoroughly saturated, when the burden of moisture became too great for the air to absorb, the moisture would be precipitated again. The cause and effect are similar to the evaporation of water by the heat of the sun from the sea, its accumulation in the form of clouds, water vapor, and its precipitation in the form of rain.

This would, of course, interfere seriously with the drying process. It is exactly what took place under the old method of drying the hats in rooms heated by steam pipes, and the only reason hats *ever* dried in such rooms was because the walls and doorways permitted a slow but constant escape of the moist air. Even then it takes a very long time to dry the bodies under such conditions, and the time thus spent means the tying up of capital upon which interest must be paid, delay in deliveries, which often means cancellation of orders, and, at

best, dissatisfaction on the part of customers. Moreover, the fuel wasted in heating these rooms and keeping them hot during a great many hours is a very considerable addition to the cost of the hats per dozen.

Various methods have been devised to overcome this expense. One was to raise the hats slowly through a steam-pipe heated chamber in which the heavy, moisture-laden air would collect at the bottom, while the drier air would be higher up, in the region from which the hats were taken from the compartment into the front shop. Another method was to place the bodies in a metal-lined compartment and force in hot, dry air, while the saturated air was pumped out. It is claimed that, while both of these methods are distinctly in advance of the older method, they are not entirely satisfactory, the former because it is rather slow and not uniform in its work, the latter because it necessitates a delay in the progress of the drying process whenever the bodies are put in or taken out.

The method in the Lee-McLachlan plant is a combination of the two just described, or, rather, it is a combination of modified forms of these two processes.

It consists of a tower, fireproof, with entrances on each floor of the back shop and front-shop wing, which it joins at their intersection. In this tower an endless-chain conveyor carries the racks full of hats up and down, from the bottom to the top and from the top to the bottom, and from one side of the shaft to the other, through an endless course. Superheated air, heated by coils fed with exhaust steam

from the power plant, is driven into the room by a powerful blower. The hot, dry air enters the tower through orifices in the floor. Passing upward, it takes up its burden of moisture from the hat bodies. Forced upward by the continuous pressure back of it, it passes out through an outlet in the roof. It has not time to cool, nor can it remain long enough to absorb more moisture than it can carry.

If the pressure were not properly regulated the hats might be blown from the racks, but the proper velocity was readily ascertained by experiment, and, once established, it was easily controlled. The temperature also is under perfect control, so that by a judicious combination of temperature and velocity the moisture is held in suspension until it passes from the room.

The hats may be taken from the racks wherever and whenever they are wanted through the doors leading to the various departments. Those not immediately required are placed in the stock room on the top floor of the back-shop wing.

VII

The Front Shop

THE purpose of the back shop is to provide a body of the requisite strength, texture, weight and color, in which the "selling" characteristics exist, but for the most part in a latent state. In the front shop these "selling" qualities are brought into prominence. They are symmetry and beauty—nothing more. It is like the work in a sculptor's studio, where the figure is roughly hewn from the mass by methods painstaking, perhaps, but somewhat more reckless than the careful work of the master sculptor who gives the stone its final details of shape and finish. Just as the errors in blocking out the rough stone may make the finishing an impossibility, so do the errors and imperfections of the back shop make the front shop work impossible, for in the finishing these imperfections are brought to light, brought into glaring prominence, in fact. So, after all, we know that the most important part of hatting, as of almost everything else, is in the foundation, in the substantial elements of the body. The beauty of a hat, being superficial in its endurance, indeed its existence, depends on the perfection of the body upon whose surface it appears.

Hat finishing, either soft or stiff, consists in shaping the body, both crown and brim, removing the protruding fur fibres that give the body a dull, fuzzy appearance, smoothing the felt with irons and pads so that the surface fibres will all lie pointing in the same direction, and trimming with bands, binding, leathers, etc. In hatting par-

lance, however, the "finishing" room is devoted to only a part of these processes, while others are conducted in other departments. We shall follow the regular procedure in this article and trace the hat through its regular course, commencing with the

FINISHING DEPARTMENT

Front shop methods in soft and stiff hat manufacture are radically different, are conducted in separate departments, and must be separately described.

SOFT HAT FINISHING

After tip and brim stretching and drying, the bodies are crown pounced. The soft hatter uses the simple upright lathe for pouncing at this stage. This lathe consists of a revolving vertical shaft with a crown-shaped wooden block at its upper end. The hat is fitted over this block and the operative, holding a pad of pouncing paper in his hands, rubs the coarse surface of the felt with it until it is sufficiently smooth. A curved collar of tin partly surrounds the circular table through which the shaft protrudes, and one or more suction pipes lead from this collar to an air pump. As the fine particles of fur are worn off they are carried away through these pipes before they have a chance to get out into the room. Sometimes the operative rubs too hard and cuts too deeply into the felt, or in pouncing he may bring to light some flaw which cannot be eradicated. In either case he simply turns the body inside out and pounces the other side. The

SOFT HAT FINISHING ROOM

brim is pounced by a machine, consisting of two rolls covered with pouncing paper, between which the brim is passed. This preliminary finishing process for soft hats is conducted on the top floor of the back shop wing of the Lee-McLachlan plant and when the hats are dried they are delivered through a door of the drying room to the soft hat finishing room on the top floor of the front shop wing.

Here they are taken in hand by the "blocker." The blocker places the hat over a jet of steam for a brief period, in order to obtain the heat and moisture which are absolutely necessary when changes in the shape of the felt are desired. Then, stretching the crown over the wooden block of exactly the right shape, he pulls the felt down snugly. He is aided in this by a wooden hand tool made especially for the purpose, which he presses against the brim as closely as possible to the block. At intervals he steams the crown and stretches it over the block. A string wound tightly around the hat where crown and brim join holds it firmly in place, and it is allowed to dry quickly.

After the blocker has stretched and shrunk the crown until it fits its block like a glove, the brim is ironed. The operative alternately dampens the felt and presses it with an iron heated by electricity. The wetting and drying "brings up" the shellac, what little there is of it in a soft hat brim. It also serves to knit the fur fibres in the brim closer together.

In ironing the crown of the hat a machine is employed. This ironing machine is one of the important labor saving inventions in

hatting machinery. It was originally invented by the late Mr. Charles Reid, but although the present machine is based upon the principles of the original invention it has been so thoroughly perfected by the inventor's nephews, Messrs. Doran Brothers, that its usefulness is enormously enhanced and it is used in every finishing shop in the country. To describe it briefly is somewhat difficult, but were we to describe every machine in detail it is possible that the reader might grow somewhat weary before our work is accomplished. Briefly, then, the hat is placed on a block at the end of a revolving horizontal shaft. An electrically heated iron on a swinging arm passes over the revolving block from side to side, ironing the entire crown. By a somewhat complicated system of gears and cams the shaft to which the block is attached is made to oscillate slightly, so that there is no "jump" as the iron passes over the quarters of the hat. The shaft also changes its speed automatically during several parts of each revolution. The result is a uniformity in ironing that cannot be excelled by hand work, and a speed in operation that enables one operator to do the work of a number working by hand. The use of electricity for heating the iron is distinctly new. Moreover, it is most certainly a benefit to the operative, for there are none of the gases of combustion vitiating the air, and it does away entirely with soot or smut that was often an objectionable feature of the gas apparatus. It means a step in advance in hat factory methods. The iron is heated to 400° Fahrenheit.

While the hat is on the block the operator wets it occasionally.

It is only by alternate wetting and drying of the felt that the pressure exerted by the iron can be made to accomplish its purpose, which is to knit the fur fibres together firmly in the positions they must hold under all future conditions of heat and cold, dryness or humidity. The hat is getting nearer to the wearer every minute and *his* requirements are receiving more attention.

After having been ironed the hat is passed to the pouncers. The brim is pounced on both sides, this time by hand. Once before, you remember, the crown and brim were pounced, just enough to remove the roughness of the felt. This time the work is more careful and thorough, for the surface given at this stage will have a great deal to do with its value from the consumer's standpoint.

Crown pouncing is very generally done by hand on the better grades of hats, although machines are also in use for this work. The pouncer works at an upright lathe with a rubber block attached, over which the hat is fitted. He rubs the surface of the felt with a pad of pouncing paper. Pouncing grease is applied to the felt by means of pads held in the hand.

Pouncing is attractive work in some ways, although the presence of fine particles of fur in the air is objectionable. It is interesting to watch the dull felt come up to a clear, bright color while the process is under way.

After the hats have been pounced and lured they are subjected to a careful scrutiny, and those improperly made or containing some flaw that cannot be eradicated are put to one side to be completed and

sold as seconds, or, if unfit even for this use, to be made into shoddy. While such imperfections as thin spots in the felt or surface dags may be noticed and remedied at earlier stages in the development of the hat, there are many other imperfections that come to light only when the finishing has progressed almost or quite to its completion. Streaks and the body dags (lumps of matted hair that have become imbedded within the felt) do not show up until the pouncing and luring have ground down the rough surface. Dags that were too minute to be readily seen in the first stages swell to twice their original size when they have absorbed the shellac stiffening and dyestuffs. Sometimes they may be removed with tweezers with but little difficulty. Often it is necessary to drop a little alcohol on the spot to dissolve the shellac before the imperfection can be removed.

At this stage the brim on the hat is uneven in outline and perfectly flat. It must be trimmed down to the proper shape and size and given the curves we see when it is ready for wear. The felt is cut down by machine. Those in general use are the Reid "Rounding Machines." The hat is placed on a block, the brim resting on a metal plate. As it revolves a knife, automatically guided, approaches the crown or withdraws from it, cutting the brim to the required dimensions.

The curl is given to the brim by means of a machine, but it is a machine that does not eliminate the necessity for skill on the part of the operative. After he dampens the edge of the brim he fits it between two small wheels. One of these wheels, the one at the back

of the machine farthest away from the hat, is heated by electricity. With one hand the curler guides the brim as it enters the wheels, bending it into the exact curl required in the finished product. The mark of a curler, by the way, used to be a scorched and scaly forefinger, a token of frequent contact with the gas flame; but with the electrc heating device this unpleasant conditon is removed. As the brim emerges from the wheels it is dampened by means of a wet sponge held in the operative's left hand. After the hat has revolved several times exactly the right curl has been given the brim. The control of the shape and size of the curl rests entirely with the operative, the machine merely pressing the felt into the shape he gives.

From this stage the hats, on racks containing a dozen each, are passed to the examiner or inspector for thorough scrutiny before they are sent to the trimming room. Before going to the trimming room let us follow the *stiff hat* through *its* course in the finishing room. This will not be much of a strain on the reader's patience, for where the processes are similar to those of the soft hat finishing department we shall make excellent progress. When we undertook to lead our readers through a "Twentieth Century Hat Factory" we did not promise to do so without subjecting them to some mental exertion.

STIFF-HAT FINISHING

In the Lee-McLachlan plant this department is on the third floor of the front shop wing.

When the hats arrive in the finishing room they are absolutely

dry. Now they are to be given a crown of the exact size and dimensions required by the prevailing fashions. This is also done by machinery. It is not flattering to our pride in Yankee shrewdness to reflect that the machine method of pressing derby hats was in use in England about a quarter of a century before it was introduced here. I will not, for good reasons, say what manufacturer first introduced the machine here. In the first place, each of the older manufacturers firmly believes that he was the first to use the machine in this country, and any hint that some other fellow did is a call to arms. After all, the introduction was not attended by much glory, for when the machines were brought here no one understood them, and they did not come into general use until some Englishmen came over here and showed us how they worked.

The old hand method consisted in ironing the crown over a block of the right shape. In the light of present trim crowns the old hand-made crowns were but sorry spectacles.

In machine pressing, the hat is placed, crown downward, in an iron mould of the exact shape that is to be given the finished crown. A flat iron ring is placed upon the brim of the hat. A rubber bag of best quality is then lowered into the crown, and the part of the machine to which this bag is attached is firmly clamped down. The operator throws open a valve and a current of water enters the bag, distending it and pressing it outward against the inside of the crown. After a few seconds the water is released, the bag raised, and the

STIFF HAT FINISHING ROOM

crown of the hat is found to have taken the exact shape of the iron mould in which it has rested.

In order that the hat will stretch, it is necessary to soften the stiffening somewhat by placing it in an oven for a few minutes before it is to be put in the press. These ovens are usually steam-heated, but in the Lee-McLachlan plant electricity is used. The steam-heating method is wasteful, in that the same pressure of steam must be used whether the hats in the oven are of the heaviest weight or the lightest. Obviously it takes less heat to soften the shellac in the latter than in the former, and, with the electric heating apparatus, this may be controlled exactly and according to clear directions. Not only is there a waste of heat in the old method, but as the same heat is applied to light weights as to heavies the former are liable to damage in the press through their excessive softness and weakness, while the latter may be insufficiently softened, and, therefore, almost equally liable to injury.

The water enters the press under pressure of several hundred pounds. This pressure is applied by a pump on the ground floor, from which a pipe leads to an iron retort in the finishing room, which, in turn, is connected to each press by smaller conduits.

The hats, although their crowns are shaped, are still rough and hairy in their superficial appearance. They must be brim-pounced and crown-pounced. The Turner brim pouncing machine is in general use. It is not a recent invention, but it is one that is highly efficient, so much so that further improvement is unlikely. It con-

sists of two rolls through which the brim is drawn, and two reciprocating pouncing pads which pounce the upper and under sides of the brim at the same time. Crown pouncing of stiff hats, as of soft hats, is usually done by hand. The hat is drawn over a block on an upright lathe, as in the case of a soft hat, but the pouncer's work presents different problems. The presence of shellac in the stiff hat changes the conditions of the work considerably, for the pouncer must be extremely careful to avoid wearing down the fur to such an extent as to reveal the hidden shellac. If it is worn too deeply even in one small spot, the work of all the other departments will be wasted, for the hat must be thrown out.

It happens that as this book was being prepared for press a new crown pouncing machine was installed in the Lee-McLachlan factory for experimental purposes on stiff hats. Naturally, the firm will proceed with caution in its use until a thorough trial has proven its value. This machine is similar in action to the ironing machine, but a rapidly reciprocating pad of pouncing paper takes the place of the electrically-heated iron. All the eccentric motions of the ironing machine are multiplied in the pouncing machine. It is so completely automatic that it may be said to actually duplicate the action of the human pouncer; but, of course, its work is done more rapidly.

The brims are then rounded as in soft hatting and the rough edge is cut to the proper dimensions. The roundings, or waste, cut off in this process may be utilized, the shellac being dissolved and recovered

ANOTHER PART OF THE STIFF HAT FINISHING ROOM

and the fur chopped up into short stock, the hatters' equivalent of shoddy.

The brims are now "edged up"—that is, turned up along the extreme edge, without regard to what is known as the curl, although the turned-up edge may be wide or narrow, according to the needs of fashion.

There is a further mechanical operation, both in soft and stiff hat manufacture, at this stage; but as it lies on the borderland between finishing and trimming, pertaining as much to one as to the other, we will save its discussion until the next chapter.

VIII

Soft Hat Trimming

IN the last chapter we mentioned the fact that there are some minor processes that are on the borderland between finishing and trimming, pertaining as much to the one as to the other. By this we refer mainly to the flanging processes. Soft hats with a raw edge are flanged but once, while those that are bound are flanged both before and after the trimmings have been affixed.

This flanging process is merely another way of doing what has been done so often before in the various processes—namely, altering the shape of the hat by means of the application of heat, moisture and pressure.

In soft hatting the flanging is a matter of hand work almost entirely. In the usual hat factory the flanger works at a bench, behind which is a broad and long iron table heated by steam. Upon this heater rests a bag of sand attached to a metal part very much like an inverted dish pan; from this part a small rope passes over a pulley in the ceiling and down within reach of the operative, where it terminates in a convenient handle. The flange is a block of wood cut to the exact shape required in the brim. Through the center of this block is a hole large enough to accommodate the crown of the hat when it is placed upside down upon the flange. The hat is fitted over this flange with considerable care, the brim is moistened, the flanger pulls the overhead cord and lifts the sand bag from the heater, letting it swing into position just over the flange. When the bag is lowered

the brim, under the influence of pressure, heat and moisture, soon takes the exact shape of the flange. It is then ironed while it is still resting on the flange, and as the hot iron removes the moisture the shape of the brim becomes fixed.

Now in the Twentieth Century Hat Factory of the Lee-McLachlan Company there are two changes that mark what we believe to be a notable advance in this process. In the first place, the sand bag above mentioned is heated by electricity, which is conducted through a copper wire coil within the bag. This does away entirely with the cumbersome and wasteful, not to say uncomfortable, heating table. Instead of a large area of surface giving off heat, to the discomfort of the operator and the loss of the owner, the heat is kept within a comparatively small space, and is capable of being regulated to a nicety. The second difference is in the fact that the irons used are, as a rule, heated by gas, which is not as cleanly as may be desired when manipulating delicate colors, and which also generates more or less fumes of combustion that cannot but be harmful to the operative who is inhaling them day after day. In this factory the irons are electrically heated.

TRIMMING ROOM

The trimming room is no place for a male visitor, and we would pass over it with utmost despatch, with our eyes straight before us, if it were possible to do so; but, although the writer has been wander-

ing through trimming rooms for the past ten years, he has never yet seen the man who could keep his eyes straight before him. Therefore, it is natural that he should note some of the interesting features of this department and be able to describe a few of the differences between the trimming room in "The Twentieth Century Hat Factory" and those of the less advanced establishments.

In soft hatting, the bands, bindings and leathers are of the utmost importance as factors in the general appearance of the hat; its beauty may be made or marred by a selection of bands and bindings. The hats themselves are made in such a great variety of colors and shades that great care and good judgment, as well as good taste, must be exercised in the selection of suitable trimmings. We shall not go into all of the infinite number of important little details pertaining to this department. It is really worth doing, but the subject is one that, to be treated fully, would require much more space than we can give it in the present instance. We will, however, cite an example of the nature of these details. There are various widths of bindings, of course; but, leaving that question aside, there are numerous factors that may add to the difficulty and expense. If the binding is to show the same width above and beneath the brim, the needle merely passes back and forth through the whole thing. If, however, the binding is to show a greater width on one side than on the other, the short side is first sewed to the brim, and, after the ribbon is turned over the edge, the long side is sewed. This doubles the number of operations.

In stiff hatting the binding may be brought together at its two

ends before it is placed on the hat and then snapped into its proper position; but in soft hatting it must be measured off, sewed on the brim, and then have its ends brought together.

The making of bows calls for skill and taste on the part of the girl operative, and the more skillful of them are very much in demand.

The Lee-McLachlan trimming room has some distinguishing characteristics that may be worth mentioning. Its lighting is one of these. Down each side of the room, hanging from the ceiling at very short intervals, there are innumerable Tungsten lights that flood the whole interior of the room with a clear, strong light, making it possible for the trimmers to see the finest work as clearly in the late afternoon as in the daytime. At each sewing machine there is a light, so arranged that it may be twisted and turned in every direction to throw its rays upon any part of the machine where they may be required.

The machines themselves are quite remarkable inventions. During some little time there has been a vogue for soft hats with parallel stitches running round the brim practically from the crown to the edge. To do this work on the regular sewing-machine, even with a guide, is an expensive process, as the work is paid for by the piece and each time around the hat is considered one operation. The latest improvement in these machines runs nine parallel stitches around the hat in one operation; there are nine spools of silk, nine needles and nine bobbins. This is beyond question a true labor-saving device. The machines, of course, are all driven by electricity.

SOFT HAT TRIMMING ROOM

The soft hats after being trimmed are returned to their racks and sent down to the packing room by elevator.

STIFF HAT MATRICING

The presence of a great deal of shellac in the brim of a stiff hat makes the process by which the shape is given to the brim much more severe. First, greater pressure must be applied, and sufficient heat to soften the shellac. Under the old method the hats were placed brim downward on a steam-heated table until the shellac had softened. These tables required a pressure of 90 pounds of steam winter and summer. The same degree of heat was given to different weights of hats, and there was, as in the older method of soft-hat flanging, a large area of heating surface that was not put to any use. This, on the face of it, was wasteful. The new method may be briefly described as follows: The table upon which the hats are laid is equipped with three copper rings, flat, and conforming roughly to the shape and width of the hat brim. These rings rest upon a thin foundation of asbestos, and are themselves made of two layers of copper with an intervening layer of mica. The electric current is conducted through them, and, on account of the resistance offered by the mica, heat is generated, which, of course, is transmitted to the hat placed upon the copper rings. Through the center of these rings a waterback conforming, in a general way, to the dimensions of the inside of a crown and filled with running cold water, keeps the temperature of the crown below the point at which the shellac would be

softened. The amount of heat generated is controlled to a nicety by a rheostat, so that there is practically no waste of heat energy whatever. After the shellac is sufficiently softened, the hat is placed once more in a press and the brim moulded into its proper shape, or "set." The iron mold is known as a matrix. As there is an infinite variety of "sets," the question of the cost of matrices is very important to the hat manufacturer. Hundreds of them must be kept on hand, and each season new ones of different shapes must be provided. Frequently much of this expense is a pure loss.

When the brim is "set" it must be planed along its edges with a hand plane, to smooth it down and sharpen it preparatory to receiving the binding. Wires are placed within the edged-up curl to insure sufficient spring to the brim. These wires are not used, however, on the finer grades. In the Lee-McLachlan factory a machine is in use for the manufacture of wires to fit the hat exactly—that is to say, when the order goes through the factory the wire maker is notified of the exact shape he is to make his hat wires, and by the time the hats reach this stage of manufacture he has the wires ready and waiting, suitably numbered and marked with the order number, etc.

STIFF HAT TRIMMING ROOM

There is no radical difference between stiff and soft hat trimming that is worthy of special consideration here.

First a girl measures and cuts off the proper length of binding for each hat, the second sews the ends together, the third stitches the

A PART OF THE STIFF HAT TRIMMING ROOM

binding to the under side of the brim by machine or hand, the fourth turns the binding up and over the edge of the curl and stitches it down by hand; the sweat leathers are then fitted loosely in each hat and passed on to be stitched to the hat by machine; the band is then stitched on, the bows attached, the labels are pasted in the crown, and the hat is ready for the packing room. We may remark, in passing, that in this factory the labels are printed and the leathers reeded and stitched on the premises.

PACKING ROOM

The hats arrive on the ground floor by elevator, although they have been conducted through the various departments on an endless chain conveyor. Arriving on the ground floor the stiff hats are put on one side of the room and the softs on the other, for inspection. They are given a last brush, polish and examination before being placed in the cardboard boxes and wooden cases or crates for shipment. If there are soft hats that are to be telescoped, the telescoping is usually done in this department, in which case the operative places some pieces of cardboard, or a metallic ring, cut to the proper height, within the crown, presses the tip inward and fits it snugly against the cardboard; he then puts a smaller ring within the indented cup, turns the hat over and presses the crown upward again. After running the creases around with his fingers, he takes out the cardboard and the telescope is complete.

The racks that have been relieved of their burden of hats are stored in this room unless they are needed in the other departments, in which case they are placed upon the endless chain conveyor, which

takes them to the finishing rooms on the upper floors. The ground floor of the front shop also contains a carpenter shop for making cases, a box factory for making the cardboard boxes, a printing plant for printing labels, etc., a machine shop for repair work, and the packing room previously described. The door of the packing room opens on a switch, so that the freight passes directly from the shop into cars for shipment to any part of the country to which it is destined.

CONCLUSION

In closing this description of the Lee-McLachlan "Twentieth Century Hat Factory" and its methods it may be well to write of some of the things that are planned, but that have not yet been executed. The whole place of several acres is to be fenced in and admission will be obtained only through the main gate, at which a watchman will be stationed. The grounds are being leveled, and a baseball field will be prepared for the workmen. A club-house is also planned, in which the employees will have every facility for recreation and enjoyment in their leisure hours. An artesian well is to be driven to provide the men and women in the factory with drinking water and for use in dyeing delicate colors.

There are many details about this establishment that have not been mentioned, and those who are familiar with it will, on concluding this reading, think of any number of little things that should have been recorded. The writer himself has some in mind; but, as it is a wise writer who knows when to stop, he feels that the stopping point has been reached, and trusts that this work has not been without interest to the readers.

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